ARS 72-30
January 1964

Proceedings of the

TWELFTH
COTTONSEED PROCESSING CLINIC

Held at New Orleans, Louisiana
February 11 and 12, 1963

AGRICULTURAL RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

PROCEEDINGS

TWELFTH COTTONSEED PROCESSING CLINIC

Held at New Orleans, Louisiana

February 11 and 12, 1963

<u>GENERAL CHAIRMAN</u>

Joseph C. Brady

<u>COCHAIRMEN</u>

E. L. Patton

L. W. Mazzeno, Jr.

<u>CONFERENCE COORDINATOR</u>

Beatrice A. Sharar

(A list of those attending the conference is in the Appendix)

CONTENTS

The Twelfth Cottonseed Processing Clinic was sponsored by the Southern Utilization Research and Development Division in cooperation with the Mississippi Valley Oilseed Processors Association, Inc. The purpose of this annual conference is to acquaint representatives of the cottonseed industry with current developments in utilization research and to provide for an exchange of information that will benefit future research.

This report, which was compiled by Leah C. Berardi and Beatrice A. Sharar of this Division, summarizes the statements of the various speakers during the conference, and gives an account of the discussions which followed. If further details regarding any particular subject are desired, it is suggested you communicate directly with the author.

C. H. Fisher
Director, Southern Utilization Research and Development Division

The statements contained in the speeches reproduced in these proceedings of the Conference are those of the speakers and do not necessarily indicate or reflect the views of the U. S. Department of Agriculture. Mention of products does not constitute their endorsement by the U. S. Department of Agriculture over others of similar nature that are not mentioned.

PROGRAM

February 11, 1963

9:00	Registration - Third Floor	
9:30	Opening Remarks	C. H. Fisher Director, SU
9:45	Twelfth Anniversary Address	J. C. Brady President, MVOPA
Presiding:	Frank B. Caldwell, Jr., Independent Oil Mill, Jackson, Tennessee	
10:10	New and Future Technology in Cottonseed Oil for Edible and Industrial Uses	R. O. Feuge Oilseed Crops Lab., SU
10:30	Intermission	
11:00	Market Outlook for Edible and Inedible Cottonseed Products	Robert Keeton Procter & Gamble
11:20	Development of New Cotton Batting Products	N. B. Knoepfler Eng. & Dev. Lab., SU
11:40	Panel Discussion	J. B. Perry Moderator Miss. Cottonseed Prods.
12:30	Lunch	
Presiding:	H. D. Fincher, Anderson, Clayton & Co., Houston, Tex.	
2:00	Improvements in Cottonseed Meal Processing Including High Protein Meal	C. M. Lyman Texas A & M
2:20	Preparation of Special Meals from Glanded and Glandless Cottonseed for Nutritional Tests	E. A. Gastrock Eng. & Dev. Lab., SU

February 11, 1963

2:35	Feeding Studies of Glanded and Glandless Cottonseed Meal	A. B. Watts Louisiana State Univ.
2:50	Precautions to Minimize Damage and Deterioration to Oil and Protein in Processing	Walton Smith Southern Cotton Oil Co.
3:10	Panel Discussion	R. B. Scherr, Moderator Buckeye Cellulose Corp. Cotton Oil Division

February 12, 1963

Presiding: Lawrence Hodges, Barrow-Agee Laboratories
Memphis, Tennessee

9:30	SU's Research Contribution to the Cottonseed Industry	M. G. Lambou K. M. Decossas Eng. & Dev. Lab., SU
9:50	An Effective Safety Program	Max White Anderson, Clayton & Co.
10:10	Intermission	
10:30	Progress Report on Pilot Plant Alumina Bleaching of Cottonseed Oil	P. H. Eaves Eng. & Dev. Lab., SU
10:50	Panel Discussion	J. L. Tennent, Jr. Moderator Delta Prods. Co.
11:30	Committee Reports	
12:00	Resume and Announcements	
	Adjournment	

OPENING REMARKS

by
C. H. Fisher
Director
Southern Utilization Research and Development Division

Mr. Chairman: It is a real privilege to welcome this splendid and alert group to the Twelfth Cottonseed Processing Clinic. This annual meeting has become one of the special events to which I personally look forward each year with a great deal of pleasant anticipation. The fact that you keep coming back year after year demonstrates an interest in our work that is most inspiring; in addition, these meetings afford a splendid opportunity for an exchange of ideas that is most helpful to us.

Because of the relation of cotton lint to cottonseed, and because of your interest in the welfare of the cotton industry as a whole, I'd like to mention two of the outstanding developments of the past year in connection with the utilization of cotton fabrics.

About 8 years ago the cotton industry was blessed with a research breakthrough of tremendous importance. I refer to the development of wash-wear products. This exciting research development increased the sale of cotton by considerably more than 1 million bales per year. This means, of course, that utilization research--conducted by many organizations--has given us a single development responsible for about 15 percent of our total domestic market.

It is possible that cotton is now on the brink of another spectacular breakthrough in utilization research, namely, that of providing all-cotton stretch products.

We have had stretch yarns and fabrics on the market for several years, but these have been synthetics, or blends based on synthetics. The big news this past year has been woven stretch fabrics made from 100 percent cotton. There has been a great amount of research on this by industry, by the Southern Laboratory, and by other research organizations. Several methods for making these all-cotton stretch fabrics have been studied intensively. These are now being commercialized, or undergoing advanced experimental evaluation.

All-cotton stretch fabrics made by slack mercerization, a process originated here, are now being supplied commercially by at least nine firms for a great variety of uses.

The market for stretch fabrics in apparel, household, and industrial uses has grown rapidly during the past several years, and it is predicted that this market will continue to grow. A study of market potential made by the National Cotton Council indicates that cotton has an opportunity of getting a major share of this growing market. It is evident that utilization research has again performed a great service to cotton by providing the new properties needed to fit cotton into specific end uses.

Flame retardant treatments for cotton are not new--but what is new in this area is that a nationwide campaign is being initiated to educate the management of hospitals, hotels, and other public institutions in the use of flame retardant fabrics as a safety measure. This campaign is sponsored by the Department of Health, Education, and Welfare, in cooperation with the National Fire Protection Association, and other interested agencies. Some of our durable flame retardant treatments, especially that based on the organophosphorus compounds called APO and THPC, are receiving major attention in this campaign.

The flame retardant APO and its cousin, called APN, have been found to be useful also in another way, namely, as chemosterilants. The compound APN looks particularly promising as a chemosterilant for boll weevil. Industry is manufacturing APN under the name of Apholate for further evaluation. These experiments are still in the early stages, but entomologists believe that a procedure of this kind may eventually eliminate the boll weevil as a threat to the cotton crop.

I'm tempted to talk about advances in research on cottonseed, but the temptation will be resisted because several other speakers will cover this subject.

I wish to thank you again for your interest, help, and attendance. I wish also to express gratitude for the privilege of cooperating with you for the benefit of those who grow, process, and consume cotton products. Best wishes for another excellent meeting!

NEW AND FUTURE TECHNOLOGY IN COTTONSEED OIL FOR EDIBLE AND INDUSTRIAL USES

by

R. O. Feuge
Oilseed Crops Laboratory
Southern Utilization Research and Development Division

The present processes used to convert crude cottonseed oil into edible products have much to recommend them by way of simplicity and low cost. Nevertheless, changes can be expected to occur. As an example, final oil products of dark color are an industry-wide problem which probably can be solved by changes in the processes of refining and bleaching. Various modifications are being investigated. Ultimate acceptance of new methods of purification will depend not only on their effectiveness and cost, but upon the success of a breeding program currently underway to produce cottonseed relatively free of pigment glands. The conversion of cottonseed oil into semisolid fats, the process of hydrogenation, is another in which changes are apt to be made. While numerous experiments have shown hydrogenated oils to behave physiologically like other hard fats, hydrogenation does produce compounds not found in natural fats. The possibility of preparing improved food products by modifying the processes of refining, bleaching, and hydrogenation are discussed.

A just completed survey of the food industries has shown that potential markets exist for new fat products which might be produced from cottonseed and other domestic oils. These new products are identified, their potential markets are quoted, and the modifications of cottonseed oil which must be effected are discussed. Particular emphasis is given to the preparation of cocoa butterlike fats, which were claimed to have the biggest market potential.

While the utilization of cottonseed oil in nonfood products is repugnant to many in the food industries, such utilization has been suggested by responsible individuals. It appears to be a logical outlet for the surplus fats and oils which cannot be sold profitably for food use either on the United States or world market. Some potential derivatives of these surplus oils should be much more valuable than are the oils.

MARKET OUTLOOK FOR EDIBLE AND INEDIBLE COTTONSEED PRODUCTS

by

Robert Keeton
Procter & Gamble Company

The attached tables summarize the statistical positions for cottonseed and soybean oils and meals. Actual figures for crop year 1961-62; and estimates for 1962-63, are shown. The estimates for 1962-63 are to be considered as being subject to revision, and are presented as being reasonable "allowances" based upon information available, in the present.

For the edible oils, the major variable in demand--and, therefore, the most important price determinant--is the volume of exports. Because the Mediterranean olive oil crop is about one-third less this year that the quantity produced last year--exportable supplies of copra and coconut oil remain relatively small--and, supplies of oils available from other exporting countries are not much changed from last year--it is apparent, therefore, that a large increased foreign requirement for United States oils exists.

However, in spite of the apparent increased foreign requirement for United States edible oils, exports, so far this crop year, have been disappointing. Because a large quantity of oil has been accumulated in anticipation of increased exports, it is rapidly becoming necessary that actual shipments of oil will have to be increased substantially in order to maintain a firm market for edible oils.

In the case of oilseed meals, there have been large increases in both domestic demand and exports so far this year. However, evidence is beginning to mount that the domestic demand for meal is deteriorating.

The number of broilers on feed, which were as much as 20 percent above last year during the fourth quarter, now are only about 2 to 3 percent above last year. Broiler prices are considerably lower than a year ago. Hog prices, also, are well below last year. These changes probably will affect the

demand for soybean meal more than cottonseed meal. An increase of about 12 percent in the number of cattle on feed should continue to provide a larger outlet for cottonseed meal. Changes in cattle numbers occur rather slowly; therefore, the domestic demand for cottonseed meal may be better maintained than the demand for soybean meal.

Exports have become of major importance in the soybean meal outlook. So far this year exports have been larger than a year ago. However, the current heavy volume of export shipments, resulting from delays due to the dock strike, will bring about at least a temporary large increase in supplies in the recipient countries. The question arises as to how long it will be before there will be much new export demand. As in the case of oil, continued heavy meal exports probably will be needed to provide support for meal prices.

CROP YEAR SUMMARIES OF MEAL SUPPLY AND DISPOSITION DATA 1/
(Thousands of tons)

Item	1961-62			1962-63 (estimated)		
	SBM	CSM	TOTAL	SBM	CSM	TOTAL
Supply						
Meal stocks, October 1	78	73	151	94	99	193
Production	10,342	2,633	12,975	10,765	2,575	13,340
Soybeans available for export and carryout	4,968	--	4,968	5,335	--	5,335
Total supply	15,388	2,706	18,094	16,194	2,674	18,868
Disposition						
Domestic feeding	9,224 2/	2,551 2/	11,775 2/	9,634 2/	2,484 2/	12,118 2/
Other domestic uses	30	30	60	30	30	60
Exports of meal	1,072	26	1,098	1,100	60	1,160
Exports of soybeans (meal equiv.)	3,606	--	3,606	4,095	--	4,095
Total disposition	13,932	2,607	16,539	14,859	2,574	17,433
Carryout						
Meal	94	99	193	95	100	195
Soybeans (meal equiv.)	1,362	--	1,362	1,240	--	1,240
Total carryout	1,456	99	1,555	1,335	100	1,435

1/ Soybean and cottonseed oil and meal supply figures based on:

	1961-62	1962-63
Soybean crush (mil. bus.)	438.8	460
Soybean exports (mil. bus.)	153.0	175
Soybean carryout (mil. bus.)	57.8	53
Cottonseed crush (thous. tons)	5,809	5,490

2/ Estimated quantity available for feeding.

CROP YEAR SUMMARIES OF OIL SUPPLY AND DISPOSITION DATA[1]

(Millions of pounds)

Item	1961-62			1962-63 estimated)		
	SBO	CSO	TOTAL	SBO	CSO	TOTAL
Supply						
Stocks, October 1	677	170	847	607	296	903
Production[2]	4,639	1,849	6,488	4,762	1,715	6,477
Soybeans available for export and carryout	2,301	--	2,301	2,440	--	2,440
Total supply	7,617	2,019	9,636	7,809	2,011	9,820
Disposition						
Apparent domestic use[2]	3,585	1,333	4,918	3,283	1,305	4,588
Exports[3]	1,124	390	1,514	1,400	385	1,785
Total oil disposition	4,709	1,723	6,432	4,683	1,690	6,373
Soybean exports (oil equiv.)	1,670	--	1,670	1,873	--	1,873
Total disposition	6,379	1,723	8,102	6,556	1,690	8,246
Carryout, September 30						
Oil	607	296	903	686	321	1,007
Soybeans (oil equiv.)	631	--	631	567	--	567
Total carryout	1,238	296	1,534	1,253	321	1,574

1/ Soybean and cottonseed oil and meal supply figures based on:

	1961-62	1962-63
Soybean crush (mil. bus.)	438.8	460
Soybean exports (mil. bus.)	153.0	175
Soybean carryout (mil. bus.)	57.8	53
Cottonseed crush (thous. tons)	5,809	5,490

2/ Excludes loss in refining.

3/ Oil only--does not include edible products exported under government donation program. The oil used in these products is included in domestic use.

SOYBEAN AND COTTONSEED OILS AND MEALS SUPPLY AND DISPOSITION

Item	Oils (millions of pounds)						Meals (thousands of tons)					
	1962-63 (estimated)			1961-62 (actual)			1962-63 (estimated)			1961-62 (actual)		
	SBO	CSO	TOTAL	SBO	CSO	TOTAL	SBM	CSM	TOTAL	SBM	CSM	TOTAL
Stocks, October 1	607	296	903	677	170	847	94	99	193	78	73	151
Production, Oct.-Dec.	1,292	678	1,970	1,197	694	1,891	2,934	1,011	3,945	2,668	976	3,644
Available, Oct.-Dec.	1,899	974	2,873	1,874	864	2,738	3,028	1,110	4,138	2,746	1,049	3,795
Less:												
Dom. disapp., Oct.-Dec.	958	362	1,320	881	370	1,251	2,557	975	3,532	2,372	965	3,337
Exports, Oct.-Dec.	223	83	306	133	102	235	376	37	413	270	2	272
Disposition, Oct.-Dec.	1,181	445	1,626	1,014	472	1,486	2,933	1,012	3,945	2,642	967	3,609
Equals:												
Stocks, January 1	718	529	1,247	860	392	1,252	95	98	193	104	82	186
Add:												
Production, Jan.-Sept.	3,470	1,037	4,507	3,442	1,155	4,597	7,831	1,564	9,395	7,674	1,657	9,331
Equals:												
Available, Jan.-Sept.	4,188	1,566	5,754	4,302	1,547	5,849	7,926	1,662	9,588	7,778	1,739	9,517
Less:												
Dom. disapp., Jan.-Sept.	2,325	943	3,268	2,704	963	3,667	7,107	1,539	8,646	6,882	1,616	8,498
Exports, Jan.-Sept.	1,177	302	1,479	991	288	1,279	724	23	747	802	24	826
Disposition, Jan.-Sept.	3,502	1,245	4,747	3,695	1,251	4,946	7,831	1,562	9,393	7,684	1,640	9,324
Equals:												
Stocks, September 30	686	321	1,007	607	296	903	95	100	195	94	99	193

Note: Production and domestic disappearance, in this table, exclude loss in refining.

DEVELOPMENT OF NEW COTTON BATTING PRODUCTS

by
N. B. Knoepfler
Engineering and Development Laboratory
Southern Utilization Research and Development Division

Research to improve cotton batting is a cooperative project jointly sponsored by the Textile Waste Association, The National Cottonseed Products Association, The National Cotton Batting Institute, The Foundation for Cotton Research and Education, and the Southern Utilization Research and Development Division.

Research was undertaken in July 1961 directed at finding a means of improving the performance of cotton batting to enable it to better compete with synthetic foams in cushioning markets. Four areas of approach were envisioned in the project: (1) Chemical or mechanical means of enhancing the performance characteristics of cotton batting including the use of resins and/or other chemical treatments to improve the resilience of the individual fibers and/or the bulk of the fibers, (2) adhesives to accomplish an improvement in the dimensional stability, coherence, and resistance to compaction upon prolonged use, (3) means of crimping, kinking, curling, interlocking either mechanically or chemically, and (4) achievement of fiber orientation other than parallel layers.

The initial phase of the research was to determine a practical method of applying the treatment. Dry powders were considered, as were spraying using solutions/suspensions, and wet immersion processing. The first-mentioned method of application was held in abeyance because most resins of this class do not chemically react with the cotton, and the last mentioned seemed too expensive to be economically feasible. Spray systems are versatile, low cost, and reasonably easily maintained.

The next phase of this research consisted of the screening of a number of types and classes of resins for their contribution to the properties of the finished product. Both thermosetting and thermoplastic resins were evaluated with particular emphasis on those resins known to be capable of reacting with the cellulose of the cotton. Resins screened include methylated methylol melamine, urea formaldehyde, acrylic, trimethylol melamine, polyethylene, acid colloids of melamine formaldehyde, and methylated methylol melamine, dimethylene ethyl carbamate, and others. Microscopic examination using cupriethylenediamine as a swelling agent indicated that some crosslinking had been achieved with some of these compounds. Several tests on physical properties indicated that some improvement had been made in the resilience of the individual fibers.

To achieve dimensional stability and coherence in the batts a series of chemical compounds classified as resinous latexes were evaluated. These include vinyl acetate copolymer, vinyl acetate homopolymer, styrene butadiene copolymer, vinyl acrylic copolymer, polyvinyl acetate homopolymer, vinyl chloride acrylic copolymers, styrene butadiene acrilonitrile copolymers, and others. For simplicity of plant operation formulations were devised so that all of the components were mutually compatible and the treatment could be applied from a single spray nozzle feed tank. Pot life of the systems were also considered. Where thermoplastic resins were used, drying temperatures in excess of 160° to 170° F. were usually sufficient to cure the resins and latexes.

In general these systems were not as good as the thermosetting resins in improving product performance. Where thermosetting resins are used, it is necessary that temperatures of 300° F. be attained for 2 to 3 minutes throughout the batt to set the resin. It has been found that products having much improved resistance to set as a result of compressional loading can be produced using these thermosetting resins. By incorporating a small percentage of the solids as butadiene styrene, the performance of resin-latex treated batts under conditions of 100 percent relative humidity can be significantly improved.

Because the products of the cotton batting industry today are sold on the basis of subjective evaluation, it has been necessary as this research developed to devise objective evaluations which would demonstrate differences in the performance of the products. One such test is the cyclic loading of a sample of batting at the rate of 1 lb. per sq. in. under conditions of 60 and 100 percent relative humidity. Data can be obtained during this test which gives the compressibility of the sample, its set after 50 repeated loadings, and its recovery over a period of time. Current research emphasis is to determine what fiber orientation contributes to the performance of the product. Efforts are being made to achieve randomization of fibers, or some type of orientation significantly different to the type of fiber array ordinarily achieved by garnetting. Manufacturers of batting have shown much interest in the new process, and several have experimentally produced the product in their plants. Samples of products using the newly developed techniques and formulations have been submitted to all of the major automobile manufacturers.

FIRST PANEL DISCUSSION

Question: No mention was made of the possibility of employing controlled hydrogenation to eliminate iso-oleic acid from cottonseed oil. Does such a possibility exist?

Mr. R. O. Feuge: This question refers to the formation of rather high-melting, unsaturated fats during hydrogenation. These fats owe their high melting point to the presence of iso-oleic acid groups whose formation proceeds much faster than does the actual hydrogenation. Much research has been directed toward reducing the proportion of iso-oleic acid groups that are formed. It should some day be possible to develop a process which will not produce such groups.

Question: What are the other methods of producing an improved cocoa butterlike fat? What are the raw materials used?

Mr. R. O. Feuge: Until recently we have been investigating the preparation of cocoa butterlike fats by the rearrangement of mixtures of completely hydrogenated cottonseed oil and olive oil. Usually three parts of the hydrogenated cottonseed oil and one part of the olive oil were used. The reaction products were fractionated to obtain the cocoa butterlike fats in yields up to 30 percent. Currently, we are

experimenting with the preparation of cocoa butterlike fats by a direct reaction between oleic acid and diglycerides of palmitic and stearic acids. Yields of cocoa butterlike fats by this process may be as high as 90 percent. A patent application covering this process has been made.

Question: To what extent would cottonseed oil be benefited by being made fully interchangeable with other oils and fats?

Mr. R. O. Feuge: I recall a recent article by Mr. Harper which stated cottonseed oil was at a disadvantage because of its higher selling price. I think cottonseed oil can be made interchangeable with other fats and oils in a hydrogenated product. Some margarine manufacturers use 80 percent soybean oil and 20 percent cottonseed oil for manufacture. The choice of a preponderance of soybean oil for product preparation is partly due to the costs involved. Cottonseed oil is not able to compete interchangeably now with other oils for production of salad oils. I think the price of cottonseed oil is one of the major considerations involved when contemplating any interchange.

Question: When trans-isomers are formed in hydrogenation is the chain twisted at the double bond or is the chain folded back upon itself?

Mr. R. O. Feuge: The n-oleic acid found in cottonseed oil is the cis-isomer. This acid actually has a hump in the middle of its chain; the chain folds back on itself. Because of this hump, the acid is relatively low melting and its crystalline-form is not very dense. The melting dilation of this acid is about one-half that of stearic acid. During hydrogenation trans-isomers of oleic acid are formed. The bonds on the carbon atoms rearrange; the chain becomes more streamlined, i.e., more linear. The trans-isomers of oleic acid are higher melting than is oleic acid. The melting dilation of the trans-isomers is greater than that of oleic acid.

Question: What do you consider to be the controlling factor in the relative demands for cottonseed oil and meal as compared to soybean oil and meal, price or quality?

Mr. Robert Keeton: There has been fairly good evidence over the years that with cottonseed oil it is the price that is the controlling factor. With this you have to consider also the lack of availability of the oil as compared to demand. Cottonseed production has not anywhere approached the continuously increasing production of soybeans. Manufacturers who years ago used only cottonseed oil for manufacture of margarines started supplementing with soybean oil and found they could obtain a product of the same market value. The lower price of the soybean oil encouraged

them to increase their usage of the soybean oil. Today most of them are employing only about 8 percent cottonseed for margarine manufacture. With regard to the matter of cottonseed meal vs. soybean meal, this is not such a straightforward thing. The meals are not interchangeable for use. The advent of the broiler industry was a big thing for the soybean meal processors. Cottonseed meal is not so readily available for broiler feeds and again there is the problem of the effects of cottonseed meal in rations for laying hens. In the case of cottonseed meal, I would say that it is mainly a factor of overall quality than a factor of price.

Question: In your opinion could the market and price for cottonseed oil be increased by an intensive and coordinated advertising campaign as was done for corn oil?

Mr. Robert Keeton: I don't know the answer to that. I doubt it. I have seen corn and safflower oils pushed as miracle products, but some of their glamour is beginning to wear off. Those oils are being used for salad oils and for margarines, but their market demand is dropping. I don't think a large scale advertising program will produce adequate results for increasing cottonseed oil usage. The price of cottonseed oil is the most important factor limiting its usage.

Question: What has been and will be the effect of the Common Market on oil and meal prices?

Mr. Robert Keeton: If the Common Market remains common, you can expect some main effects on meal consumption. This should make for an increased demand for meal even though we have already lost a fairly sizable export market for broilers. Those countries in Europe are starting out on the same lines as this country did. If you think back over the years about what happened here, you can expect soybean meal demand to average higher than now because we would have increased export markets. The opposite is true of the oil picture. Those countries have oil suppliers and will get their oil needs from their own suppliers, i.e., peanut producers. Countries were producing less peanut oil, but now more countries have started producing more peanut oil. I don't see any connection between the Common Market and a very greatly increased demand for soybean oil.

Question: Do you feel broiler consumption in Common Market will go up?

Mr. Robert Keeton: Yes, I think it will. This is a wonderful source of meat. This increased consumption will bring increased broiler production.

Mr. J. B. Perry: Is it not true that the supply of fats and protein is short in the Common Market countries and that the mid-south area (U.S.A.) has a surplus? While our export of broilers might decrease due to Common Market production, would not likewise our exports of fat and protein increase?

Mr. Robert Keeton: Yes, I agree with you. This would ultimately cause an increase in our exports.

Question: Were the colors in the samples intended as decorator colors?

Mr. N. B. Knoepfler: The colors were imparted to the cotton batting for identification purposes and to allow us to follow the distribution of resin in the samples. The mattress and furniture manufacturers think the colors are a selling point, while the auto manufacturers think the colors will allow them to code for the various types of batting products used in auto manufacture.

Question: Could a wearing surface, to replace the normal upholstery fabric, be built up on a formed bat, as a second step?

Mr. N. B. Knoepfler: I don't know whether this can be done. Heat-sealable vinyls are being used for upholstery of car doors by automobile manufacturers. We hope some day to develop a similar heat sealable product for use with cotton batting.

Question: Has any study been made by batting people themselves as to the relative cost of your new product compared to the cost of conventional batting?

Mr. N. B. Knoepfler: Not up to the present time. While many manufacturers are interested in using this new batting, none have gone into actual production. Our present results indicate that the density of the product can be reduced by about 20 to 25 percent. This gain is in part overcome by the cost of the chemicals. I think the new product should sell for not more than 2-1/2 to 3-1/2 cents per pound more than present commercial battings. On a unit basis (mattress, cushion, etc.), the cost should be the same as for untreated batting. As the usage of the resin employed for manufacture of this new batting is increased, this will naturally bring about a decrease in the price of the chemical required.

Mr. J. B. Perry: I noted your mention of linter quality. Several years ago I attended a meeting in Memphis with industrial users of linters. They stressed their need for better quality linters. They were asked how much they were willing to pay for higher quality; they wanted better quality linters at cheaper prices. I remember Hal Harris standing up and telling them to lay the money on the line and then

they would get a higher quality product. I wish to make one other observation about a subject in your paper. You mentioned shortness of linters. This could be due to ginning techniques. But there are some who think you cannot overlook shortness of linters fibre as being due to breeding. The area of linter source has a lot to do with the linter quality in addition to ginning practices. Mr. Knoepfler, your results are most interesting. We certainly need a breakthrough on this linter problem.

IMPROVEMENTS IN COTTONSEED MEAL PROCESSING INCLUDING HIGH PROTEIN MEAL

by

Carl M. Lyman
A. & M. College of Texas

The determination of lysine with free epsilon amino groups (sometimes termed available lysine) continues to be one of the most effective tests for protein quality in cottonseed meal. When gossypol, carbohydrate, or any other substance reacts with the lysine in the protein, then the digestive enzymes pepsin and trypsin have difficulty in taking the protein apart so that the individual amino acids can be absorbed into the blood stream. Experimental data showing the effect of blocking lysine on the digestion process will be shown.

Although the significance of these reactions with lysine have been repeatedly demonstrated, there are also other important factors. One of these is now known to be the physical state of the protein. In experimental laboratory processing tests, it was found that the following procedure produces a meal with considerably different physical characteristics and a protein quality index which is higher than would be predicted on the basis of the content of lysine with free epsilon amino groups (available lysine).

> The rolled cottonseed meats are heated to a temperature slightly above the boiling point of water, then the water is added hot and after a short time the water is removed rapidly. In order to accomplish this, conditions for effective heat exchange are necessary.

The resulting meal is soft in texture and what is more important, the solubility of the protein remains high. The result is that the digestion of the protein is more complete and small animal feeding trials indicate high protein quality. At the same time, free gossypol is reduced to satisfactory levels. Experimental data concerning this concept will be presented. Preliminary tests suggest that oil color as well as meal quality is improved by these processing conditions.

Several approaches to the problem of producing high protein meals and flours suitable for human use will be briefly discussed.

PREPARATION OF SPECIAL MEALS FROM GLANDED AND GLANDLESS COTTONSEED FOR NUTRITIONAL TESTS

by
E. A. Gastrock
Engineering and Development Laboratory
Southern Utilization Research and Development Division

The chemical analyses of the eight special meals from glanded and glandless cottonseed for nutritional tests are shown in Table I of the hand-out. As indicated, four of these meals were prepared at the Southern Utilization Research and Development Division using a mixed solvent composed of hexane, 39 percent; acetone, 57 percent; and water 4 percent--all by weight. The other four were prepared at College Station, Texas, under Mr. Wamble's direction using hexane. Four of the meals were from glanded seed and four were from glandless. Four of the meals were prepared using heat and a cooking procedure, such as is used in preparing cottonseed flakes for prepressing, and four were prepared without heat.

At the Southern Utilization Research and Development Division the extractions were carried out batchwise over periods of from 26 to 96 hours in a tilting type of extractor devised by one of our operators in the pilot plant. Ten washes with fresh solvent were used with soaking and draining periods of 35 minutes each for each wash except that extractions lasting 26 hours included an overnight soak and extractions lasting 75 and 96 hours included soaking over a weekend. Solvent/flake ratios varied from 12 to nearly 15/1.0. Flakes were 0.010 in. thick. Meals were desolventized (air dried) on trays.

At College Station a 55-gallon vertical batch extractor was used with several alternate periods of 1 hour's standing covered by solvent followed by four hours' draining. Solvent/flake ratios varied from 5 up to about 12 to 1.0. Flakes were prepared in the Flak-all machine.

Extracted marc from uncooked flakes was desolventized by blowing warm air through it or by spreading it on the floor. Extracted marc from cooked flakes was desolventized in a continuous pilot plant steam-heated desolventizer. Residence time 12 min. max. temperature 200° F.

In the further development of the mixed solvent extraction process in the pilot plant, meals have been prepared analyzing free gossypol, 0.01 percent; total gossypol, 0.18 percent; lipids, 0.50 percent; EAF lysine, 4.2 g. per 16.0 g. nitrogen using 40 minutes extraction in the basket extractor followed by 40 minutes extraction in the inclined screw extractor.

FEEDING STUDIES OF GLANDED AND GLANDLESS COTTONSEED MEAL

by
A. B. Watts and Charles Johnston
Poultry Science Department
Louisiana State University

[Presented by A. B. Watts]

Cottonseed meals produced from glanded and glandless varieties of cottonseed have been evaluated in commercial type 21 percent protein broiler rations.

Commercial type broiler chicks were used throughout and the chicks were brooded in electrically heated batteries and transferred to finishing batteries, when kept over 4 weeks, until the birds were 8 weeks of age.

The cottonseed meals were included in the rations as the major source of protein with corn, Fermacto 400 and alfalfa leaf meal supplying about 4.5 percent of the total protein. These rations were made isocaloric and isonitrogenous by the addition of corn oil and rice hulls.

The effects of mild heat treatment, lysine and methionine supplementation, hexane extraction and extraction with a homogenous solvent mixture composed of hexane-acetone and water were evaluated in tests lasting from 2 to 8 weeks.

Analysis of the meals shows that extraction of the oil with the homogenous solvent mixture removed much more free and total gossypol from glanded seed than extraction with hexane.

Mildly heating the glanded seed prior to extraction produces meals which have much higher total gossypol content but the same free gossypol content. Heating the glandless seed had no measurable effect on the gossypol content.

The results of the chick feeding tests indicate that glandless cottonseed meals produced by extraction with the homogenous solvent mixture were of significantly higher quality than those meals produced by extraction with hexane. However, when the glandless seed was subjected to mild heat treatment prior to extraction with hexane, the meals produced were of higher nutritional value than those produced without any heat treatment.

Heat treatment of the seed prior to extraction with the homogenous solvent mixture resulted in meals which were of slightly less nutritional value than those which were not heated.

Lysine supplementation at the 0.3 percent level was of value in all rations but of particular value when added to rations in which the meals came from glanded seed and were produced by extraction with the homogenous solvent mixture. Methionine supplementation at the 0.2 percent level resulted in no further increase in efficiency over that produced by lysine supplementation alone.

Pilot plant production of glandless cottonseed meals by solvent extraction and by grinding screwpress cake produced meals which were of significantly higher nutritional value than glanded meals produced by the same methods and good quality commercial cottonseed meals. The highest quality glandless cottonseed meals were equal to soybean meal in feeding value.

PRECAUTIONS TO MINIMIZE DAMAGE AND DETERIORATION TO OIL AND PROTEIN IN PROCESSING

by
Walton Smith
Southern Cotton Oil Division
Hunt Foods and Industries, Inc.

Precautions should begin when cottonseed are being received at the mill. Chemically treated cottonseed for planting purposes should not be purchased

as crushing seed since the chemicals used in treatment may result in seizure of oil and possibly meal by the Food and Drug Administration authorities. Adequate cooling of seed is necessary to limit the free fatty acid rise resulting in inferior quality of oil.

Rolling cottonseed meats is very important. A flake thickness greater than eight- to ten-thousandths inch thickness will result in increased refining loss and increased color. Introduction of moisture to meats prior to rolling is important to permit proper cooking to minimize oil in protein damage. A rapid rise in temperature in the top cooker ring to about 190° is necessary to hold down refining loss. The temperature of meats leaving the cooker should be no higher than is necessary for good extraction, or protein damage will result. Mechanical presses should be kept in good condition in order that a minimum of screening tank material may be recooked and repressed, or just repressed. Prompt and adequate cooling of cake leaving the press room will prevent further darkening of meal and damage to protein.

Care should be taken to insure that lubricants do not contaminate the cottonseed oil. Lubricants should be used containing no toxic compounds which could result in contamination of oil or meal.

SECOND PANEL DISCUSSION

Question: If a nonradioactive gossypol sample were administered to an animal, is there a chemical test for detecting or measuring the gossypol deposited in tissue of the animal?

Dr. C. M. Lyman: This is certainly a pertinent question. With the present published methods for gossypol determination, we cannot accurately measure the amount of gossypol in tissues. Sometimes we have obtained a value for tissue gossypol content which was a third or more larger than the amount of gossypol administered. Dr. F. H. Smith of North Carolina has been working on this problem of analysis. He has made some very fine contributions on methods of analysis for determination of free and bound gossypol in cottonseed and meals. He has been improving present analytical methods so they can be applied to analysis of tissues. I understand he can quantitatively determine the amount of gossypol in livers. His methods should be published in the near future.

Question: What are typical times and rates involved in your treatment which you describe as "water added hot and after a short time rapidly removed?"

Dr. C. M. Lyman: The cottonseed meats are raised to a temperature of the boiling point of water and then the hot water is added. The meats with added water are cooked for a total time of 20 to 30 minutes. This allows for removal of a lot of the water.

Question: What do you mean by a soft meal?

Dr. C. M. Lyman: The soft meal I described was an experimental meal which readily crumbled when held in the hand. We are investigating this treatment in conjunction with hydraulic and screw press methods in Mr. Wamble's processing laboratory at College Station. We have only partially accomplished our objectives and have not completed our studies. I know that meals produced by this hot water treatment and screw pressing will be much softer.

Question: Do you have an opinion on the qualities of oil and meal prepared by your procedure?

Dr. C. M. Lyman: This matter of water treatment is not a new idea. I'm sure it has been tried at some time in industry. My main objective is the prevention of heat transfer through our procedure. This is an important fact that has to be considered. The heating of the meats and then the addition of the hot water to the heated meats decrease chances for heat transfer. The quality of the oil is improved if we can reach the necessary temperature. I have told you that the protein quality index of the meal is higher than would be expected on the basis of its available lysine content. There should be less free gossypol going into the final oil.

Mr. E. A. Gastrock: The water and cooking treatment is not different from the cooking procedure employed in the filtration-extraction process.

Dr. C. M. Lyman: Yes. And you end up with a porous material by that method, too. As I said, this hot water treatment is not a new idea.

Question: Is your water-cooking treatment designed for the flakes or for treatment of the final meal?

Dr. C. M. Lyman: I was talking about its application to rolled meats and not to the finally processed meal.

Question: What was the oil content after the basket extractor and before inclined slurry extractor? If we have good industrial plant extraction with 40 minutes in the basket extractor, why wouldn't 5 or 10 minutes in the inclined slurry extractor be enough?

Mr. E. A. Gastrock: We haven't explored all the possibilities of varying the amounts of time required. The oil content before the inclined extractor varies from 1-3/4 to 10 percent. The content of the meal coming from the inclined extractor is about 0.5 percent. A longer period in the inclined slurry extractor would be more favorable for lowering lipid content of the meal. We have to wait for the results from all feeding tests conducted with the

hexane-acetone-water meals. Results of those tests may show that we do not need to produce a meal with lipid content as low as 0.5 percent. If a higher lipid content meal is found to have high nutritive quality, then the amount of time the meal remains in the inclined slurry extractor can be shortened.

Question: In mixed solvent there is 1 percent water. The purpose of the inclined slurry conveyor is to take out the water immediately. Why put the water in?

Mr. E. A. Gastrock: I don't know why it works that way, but it does by adding water at that step.

Mr. H. D. Fincher: Ed, isn't the purpose of the water to break the pigment glands?

Mr. R. B. Scherr: Then the point is do you want to break the glands at the beginning of the process or in the inclined extractor.

Mr. H. D. Fincher: The water in the inclined extractor will rupture the glands which have escaped breakage during the previous steps of the process.

Mr. E. A. Gastrock: Yes, the water addition at end will pick out those glands which escaped rupture and cause a lowering of free gossypol content. We had a meal that contained 1 percent oil, 0.2 percent total gossypol and 0.05 to 0.07 percent free gossypol. The meal was desolventized at a temperature lower than 185° with and without added water. Desolventization without water addition caused a free gossypol lowering to 0.03 percent. Desolventization with added water lowered the free gossypol content to 0.01 percent.

Question: Would you say that the hexane-acetone-water extracted meals were as good nutritionally as the glandless meals?

Dr. A. B. Watts: They were awfully close. Some of the mixed solvent glanded meals were almost as good as the glandless meal samples. They approached very closely the nutritive quality of the glandless meals.

Question: Is it possible that the hexane-acetone-water solvent increases the nutritive value of the meal by increasing the availability of the amino acids rather than removing an antinutritional factor?

Dr. A. B. Watts: This is a very good question. It is one that we are exploring. I expect it is a matter of digestion. We are trying to explain it on basis of availability. Availability seems to be increased as much as from 45 to 98 percent. This point has to be studied with regard to all of the amino acids of the meal and not only

with regard to lysine. It is a very tricky thing to do. In our studies surgically modified chicks are used; this enables us to collect urine and fecal samples from the chicks and allows accurate accounting of the protein consumed and assimilated. Various chromatographic procedures are being used for determination of the amino acid contents.

Comment: I expect the glandless meal to be so much better than the HAW glanded meal.

Dr. A. B. Watts: No. As I said the HAW glanded meal closely approached the nutritive value of HAW glandless meal or hexane-extracted glandless meal provided the latter was heated before extraction. On basis of the better nutritive quality of the cooked and then hexane-extracted glandless meal, there may be present in cottonseed a factor other than gossypol which is deterent to growth. This possible factor is what you may have heard referred to as the antinutritional heat-labile factor.

Question: Am I correct in understanding that for a given processing procedure there is not too much difference between glanded and glandless meals and there is more difference in results if mixed solvent is used than hexane?

Dr. A. B. Watts: No, this is not the case. With regard to only the HAW or mixed solvent process, there are obtained glanded and glandless meals whose nutritive values are very high and of somewhat the same magnitude. Heated, hexane-extracted glandless is of as high quality as mixed solvent glandless. In the case of hexane-extracted glanded meals you have a gossypol problem.

Question: Do you think physical change is responsible for the improved value of the cooked, hexane-extracted glandless meal?

Dr. A. B. Watts: We can't get the maximum nutritive value of the hexane-extracted glandless meal unless that meal is precooked. Mr. Johnston, the coauthor of this paper, is working toward his Ph.D. degree and is investigating this effect of heat treatment. We do not think the heat treatment is successful mainly because of a lowering of gossypol since the glandless meals do not contain gossypol as such. Perhaps the first step is destruction of an unidentified factor by heat. But certainly the effect of physical change of the protein on its nutritive quality cannot be overlooked.

Question: Is it correct that for a given processing procedure there was little difference in nutritive value between glanded and glandless, but great differences between intake by animal of those meals?

Dr. A. B. Watts: Glanded or glandless meals prepared by the mixed solvent process were of almost the same quality. Hexane-extracted glandless meal had to be precooked in order to obtain a similar high nutritive value. The differences in these three types of meals I have mentioned were in the amounts of meal taken in by the chicks. More growth per amount of meal consumed was obtained with the glandless meals. Let me define protein value. We measure it as the grams of gain per unit protein intake. In a meal containing a high gossypol content, the matter of gossypol toxicity has to be considered when you talk about growth. But with the meals I have discussed the gossypol contents were very low. Therefore, gossypol toxicity should not enter into the picture.

Question: Do you know extent of heat necessary to inactivate heat-labile factor?

Dr. A. B. Watts: Mr. Johnston is working on this. We think 30 minutes heating at 180° F. of the glandless meats should do the trick. It is necessary to heat before hexane extracting. A hexane-extracted meal was heated and no improvement was shown. In the laboratory we were adding a small amount of water and heating the hexane-extracted meal and found that we missed the boat about the factor. You have to heat before the hexane extraction.

Question: Is that dry-heating?

Dr. A. B. Watts: Yes. The dry-heating does the trick.

Dr. A. Smith: If you take two commercial meals of the same free gossypol content and feed those meals with animal intake being the same in both cases, but one meal has a nitrogen solubility value of 75 and the other a value of 50, what would be the relative nutritive values of those two meals?

Dr. A. B. Watts: In a study made with SU a few years ago we found a 0.9 correlation value was obtained between nutritive quality and protein solubility in a series of prepressed solvent-extracted meals. However, when you compare meals prepared by different processing methods, there is poor correlation between nutritive quality and nitrogen solubility. In the case of your two meals, I would not know their relative nutritive values.

Dr. A. Smith: But suppose the two meals were made by the same commercial processing machinery and their intake by the test animals was the same?

Dr. A. B. Watts: I have no concept of what the nutritive qualities would be.

Dr. A. Smith: Would you say that a 10 to 20 percent difference in nitrogen solubility would produce vastly different quality meals?

Dr. A. B. Watts: I know nitrogen solubility is not the most important criterion or estimate of meal quality. We have conducted tests with meals which were cooked under acid and alkaline conditions at SU laboratory by Dr. Thurber and Mr. King. In those meals the pH and moisture during cooking had an effect on meal quality. Some of the best cottonseed meals we have ever tested were prepared by alkaline cooking of glanded seed.

Dr. C. M. Lyman: Nitrogen solubility can be a useful index of meal quality within a given type of processing. On the other hand, we know that you can take a high quality meal having a nitrogen solubility value of 85 percent and obtain no difference in nutritive quality when the meal is further subjected to the hot water treatment for 30 minutes even though this treatment causes a drop in nitrogen solubility to 35 percent. This means that you have to be careful as to the way nitrogen solubility is interpreted. As I observe the nitrogen solubility determination, it appears to be an indication of the physical condition of the meal, a condition that cannot be indicated by any other handle. It can serve as an index of quality only for meals prepared within some one special process.

Dr. A. B. Watts: Dr. Lyman developed a method for calculating nutritive index of meals. I think that with lysine availability entering the picture, this value should be included in calculation of a new nutritive index formula. However, we cannot neglect even the unessential amino acid when we are talking about proteins. Nitrogen solubility is a useful tool in measuring meals prepared by the same processing method.

Mr. Garlon A. Harper: Dr. Watts, may we see the last slide you showed in your discussion? Do you consider that the material shown in that slide is very representative?

Dr. A. B. Watts: Please show slide No. F. Yes, I will say the data shown in that slide are very representative of the samples we have tested.

Mr. R. B. Scherr: While we are waiting for our projectionist to get the slide, I will continue with some more of the questions you have asked.

Question: Why does the failure to flake properly affect oil color?

Mr. W. Smith: I'm not an organic chemist and I have no explanation for that effect on oil color. It probably is caused in some way by the mechanical action done by the crushing rolls

on the pigment glands and oil cells. But I do know that if you flake improperly the resulting oil is usually of poor color.

Question: Oil is being produced with laboratory refined colors of 7.6 R or better and with bleach up to 3 to 4 R on laboratory or plant refined oil. What do you think is the principal cause of such poor bleach?

Mr. W. Smith: Perhaps the gentleman who asked that question is from South Texas. Much smarter men that I have worked on this problem, and the reason was never learned. I do know that there are some oils from South Texas that have bleach colors as high as their refined colors.

Comment: South Texas oil is one thing. But with other oils I would look into the matter of contaminating red color as perhaps due to petroleum lubricants used on mill machinery. We make also a point to use iron fittings and pipes and avoid those of copper or brass. I seriously think the lubricants should be looked into as a factor in this problem of bleach color.

Mr. R. B. Scherr: Dr. Watts, your slide is ready. Will you please come to the speaker's platform?

Dr. A. B. Watts: This is the slide about which Mr. Harper was asking. The data here are very representative. Data were obtained on triplicate lots of chicks and we had good reproducibility. With the mixed solvent meals and the heated, hexane-extracted glandless meal there were good gains and good intake. The protein efficiencies of these particular cottonseed meals approached very closely that of the soybean meal used in our test. The soybean meal was a 50 percent protein meal and the best we could buy on the market. We are trying to get some screw press cottonseed meals of very low gossypol content for testing in the same manner. You can see that results of tests in which the three commercial cottonseed meals shown in this slide were supplemented for soybean meal in the ration were not bad; results were in line with what we normally expect when replacing soybean meal with commercial cottonseed meals. With respect to the HAW glandless meals, those meals can be supplemented for soybean meal on any basis. However, they were no better than the heated hexane-extracted glandless meals.

Question: Were the laboratory prepared HAW glanded meals in that particular test?

Dr. A. B. Watts: Not in this particular test. But in other tests we did get values of 2.2 or very close to 2.2 with HAW glanded meals. The birds used were tested for 8-week growing period. During the first 4 weeks of growth you can get

values of 3 to 3.2, but as the birds get older, evaluation of meal by them becomes less critical. It is more critical between first 3 to 4 weeks of growth. We feel the 8 weeks' feeding period demonstrates the growth you could expect up to the time the bird is ready for market, and this is what the farmer and feed manufacturer are interested in.

Question: Mr. Harper, how many commercial seed breeders are now breeding their seed with glandless seed?

Mr. Garlon A. Harper: We do not know of a single major commercial seed breeder who is not working to incorporate the glandless factor into his varieties. The commercial breeding work with glandlessness started about 5 years ago. I would say that the appearance of glandless seed on the West Coast market will be a fact in the near future. In other parts of the country this realization will be longer in coming.

Question: What is the possibility of using water separately and using it halfway down the inclined conveyor?

Mr. E. A. Gastrock: I don't know. We haven't tried that. There are so many variables possible and all of them have to be studied so we can get the most satisfactory procedure. The people working out the procedure have been under terrific pressure to complete each test run. We make each run like it is going to be the last one in the series.

RESEARCH CONTRIBUTIONS TO THE COTTONSEED INDUSTRY BY THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

by

Madeline G. Lambou and Kenneth M. Decossas
Engineering and Development Laboratory
Southern Utilization Research and Development Division

[Presented by Madeline G. Lambou]

The Southern Utilization Research and Development Division has cooperated with segments of the cottonseed industry, other Government agencies and universities in research achievements of importance to the welfare of the industry. Selected achievements cited are those which have been commercialized and an effort has been made to estimate the dollar value. These include: Improved recovery of solvent and oil, and improved color of oil from solvent-extracted cottonseed; improved preparation of cottonseed for processing; high shear refining to improve color of cottonseed oils; filtration extraction of cottonseed; a continuous feeder for the filtration-extraction process; and mechanical upgrading of cottonseed.

It is believed that there are many other research contributions which cannot be analyzed in this way. Collectively, these share an important but intangible contribution toward commercialization of the developments mentioned above. It is not possible to list all of these for there are too many. Where possible, some have been incorporated in the paper to show the basic work underlying the commercial development. Others have been discussed under "new methods" and include: A bench scale method for evaluating the processing characteristics of oilseed for filtration extraction; methods for determining gossypol; the Southern Utilization Research and Development Division's hardness tester; an improved method for available lysine; a method for determining cyclopropene acids and, an improved method for measuring oil color.

Several new products are also discussed. Those outlined include: The acetoglycerides; a high quality cottonseed meal for meat birds and swine feeding; methyl esters from cottonseed soapstocks; and, improved cotton linters for use in paper making.

At best, dollar values of research developments are difficult to measure accurately. Our firmest estimates lead us to believe that cumulatively the cited achievements probably exceed the $35 million mark and potentially high-value products are looming on the horizon. However, it is believed that value of the indirect contributions of the Southern Division's basic and exploratory research for which dollar values cannot presently be calculated exceeds the cumulative value of the more direct contributions. It is estimated that together the direct and indirect contributions lie conservatively between $35 and $70 million.

AN EFFECTIVE SAFETY PROGRAM

by
Max White
Anderson, Clayton and Company

Since my topic of discussion today is "An Effective Safety Program," I think it would be well first to arrive at a reasonable definition of such a program. The National Safety Council defines an effective program as "the planned enlisting and maintaining of support of all personnel of the entire shop, firm, or industrial establishment for the prevention of accidents." Secondly, it would seem pertinent to adequately define an accident since there are many persons who do not fully understand the broad scope of the word "accident." One definition of an accident is "an undesirable or unfortunate happening; an unexpected or unintentional happening." Nowhere in this definition do we see a mention of personal injury. Hence, for our purpose, we might say that an accident is any unplanned interruption to the production process. Many industrial accidents do not involve personal injury or damage to equipment, but simply delay the production processes. With these thoughts in mind, I will now proceed to outline and discuss those items that are commonly recognized as being the essential parts of an effective program. They are as follows:

1. Management Support and Participation.
2. Supervisory Participation.
3. Adequate Safety Organization.

4. Adequate Employee Selection and Training.
5. Maintenance of Plant and Equipment.
6. Adequate Medical Program.

Now let us discuss to some detail each of the above items.

1. Management Support and Participation - Management must indicate their interest and desires in safety through actions as well as by words. A letter from the company president outlining his desires or a few brief words at an employee meeting may be all that is necessary. In a smaller operation, simply complying with company safety rules while making plant visits may be all that is necessary for management to do in convincing the individual employee of management's interest in safety.

2. Supervisory Participation - In my estimation the supervisor or foreman is the key to any safety program. He is the link between management and the employee. He must not only preach and teach safety, but most definitely should practice safety at all times.

3. Adequate Safety Organization - The size and type of company operation will determine the extent of the safety organization. A large, extensive operation might require the services of a safety director, regular safety meeting and other such activities whereas the smaller company might have an adequate organization by assigning one supervisor the responsibility of conducting a monthly inspection of all facilities and keeping a tabulation of all plant accidents.

4. Employee Selection and Training - It is essential that the right man be placed on the right job. Some companies accomplish this through extensive physical examination programs and psychological testing while others may depend on the judgment of the plant superintendent or office manager. Regardless of the method used to select the employee, once he is hired, he must receive the necessary training to accomplish his job in a safe, efficient manner. A short cut in the area of training will lead to inefficient unsafe operations.

5. Maintenance of Plant and Equipment - Keeping the plant and equipment in safe working order is a must. Substandard plant and equipment maintenance is an indication of inefficient operation which can only lead to excessive injuries and dollars lost.

6. Adequate Medical Program - Depending on conditions and plant needs, a medical program may mean a full time in-plant nurse or simply one employee trained in the basic essentials of first aid. Prompt, reliable medical care must be provided once an injury occurs. Otherwise, very minor injuries may develop into serious ones.

Production and safety are inseparable. The above important aspects of an effective safety program have been discussed with this thought in mind. Evaluate your existing program to determine if it can't be strengthened or improved by utilizing one or more of the ideas discussed here today.

PROGRESS REPORT ON PILOT PLANT ALUMINA BLEACHING OF COTTONSEED OIL

by

P. H. Eaves
Engineering and Development Laboratory
Southern Utilization Research and Development Division

In developing the laboratory method of bleaching off-colored cottonseed oils with activated alumina into a pilot plant process, it has been found that the conditions giving the maximum bleaching effect with any given activated alumina and any given oil consist of (1) mixing the alumina into the oil with sufficient intensity to thoroughly disperse the alumina in the oil, (2) heating the mixture under high vacuum (0-5 mm. Hg. abs.) for 20 minutes at $440^{\circ} \pm 5^{\circ}$ F.

Alumina dosage (for any given alumina) varies with the individual oil. Of 10 off-colored oils examined to date, eight were bleached to colors of 2.5 red or lower with from 1.8 to 4.0 percent of alumina. The remaining two oils required heavier dosages.

The first major problem encountered in the work was that of obtaining an alumina having the proper particle size makeup to give good bleaching efficiency while filtering at a rate comparable with that required for commercial operation. By air separating pulverized activated alumina pellets, a sized alumina fraction was prepared which meets the bleaching efficiency requirement and which, when used in admixture with one part perlite filter aid to four parts alumina, also meets filtering rate requirements.

A second major problem has been that of finding a commercial source of activated alumina of the required particle size makeup and bleaching efficiency at a price low enough for use in the process. A major alumina manufacturer is now actively working to produce an alumina meeting these specifications and will shortly supply the quantities required for use in pilot plant work in which 200 pound batches of oil will be bleached.

The future of the alumina bleaching process appears at this time to be dependent on the ability of alumina manufacturers to supply an alumina of suitable properties in quantity at economically feasible prices.

THIRD PANEL DISCUSSION

Question:	Did any of the oil tested with alumina bleaching method contain any petroleum oils or grease?
Mr. P. H. Eaves:	Not to our knowledge; however, we did not analyze for these substances.
Question:	I think you said deodorizing equipment could be used for bleaching. Can steam be used for agitation?

Mr. P. H. Eaves: I have done some experiments on this and based on experimental data, steam can be used for agitation. I have been unable to detect any odor or taste in the oils bleached in this way. I believe you examined some of these oils. We did have some bleached oils that developed undesirable characteristics, but those samples had been sitting around for a long period and the change was probably caused by oxidation.

Question: Was the bleaching by that method as efficient?

Mr. P. H. Eaves: Bleaching in the deodorizer with only steam for agitation was not quite as efficient as was the usual alumina bleaching procedure. However, for most oils, bleaching in the deodorizer gives a satisfactory color reduction. In general, deodorizer bleaching gives an oil which has 0.1 to 0.3 more red color than the same oil bleached by the usual alumina bleaching method.

Question: Could you compensate for increasing color by increasing the amount of alumina used?

Mr. P. H. Eaves: Yes, more alumina will bring the color down. An oil having a 13 bleach color with use of 4 percent alumina was brought down to an 8 bleach color with 6 percent alumina. This was one of those very red refined South Texas oils. From graphic data obtained by plotting the color of the oil on a logarithmic scale and the percentage of alumina required for bleaching on a regular graph paper scale, the data showed that 18 percent alumina would have bleached that particular oil to a water-white color.

Question: Do you have any explanation for the 0.1 bleach oil color you showed on slide?

Mr. P. H. Eaves: Yes, that oil had a lot of green color. The green is complimentary to red, and this would naturally block out the red upon reading the oil, even though the visual color of the oil to the eye would be darker than would be expected with an oil of only 0.1 red color.

Question: It appears that you have made good progress in this field of alumina bleaching. Would you say that alumina bleaching could be competitive with earth bleaching on an economic basis when used with oils that can be bleached to good color with earth?

Mr. P. H. Eaves: I would say this could be done on an economic basis. The reason is that a smaller amount of alumina is required for bleaching those oils which normally bleach well. Not more than 1-1/4 percent alumina would be needed. I want to make mention of the fact that some carbon will be needed for this bleaching operation

since the carbon is needed to take out the green color which the alumina does not take out. The alumina has no adsorption capacity for green pigment.

Question: For the past 5 to 7 years the solvent process has remained at or near 30 percent for cottonseed crushed. Has the sale of solvent process reached its peak?

Mrs. M. G. Lambou: I think you're asking the wrong person, because I am certain there are some here who have had considerable experience in the commercial solvent extraction field. In my opinion the solvent process has not reached its peak. We have heard just recently that four mills on the West Coast are about to be or have been completely converted from expeller mills to prepress solvent extraction. I don't think the solvent process has reached its peak.

Dr. A. E. MacGee: I want to compliment you, Mrs. Lambou, for your very fine presentation. I would like to make a remark regarding the date you showed for solvent extraction in your slide. I think solvent extraction was actually undertaken at an earlier date. Commercial solvent extraction for cottonseed became a reality in 1947 and 1948. The 200 tons per day plant of Delta Products at Wilson, Ark., went on stream in March 1947. The Buckeye Cotton Oil Company's 350 tons per day soybean-cottonseed plant went on stream in Memphis, Tenn., in February 1947, but started up on soybeans, shifting later that year to cottonseed. The 100 tons per day plant of West Texas Cotton Oil at Abilene began operations in April 1947. Subsequently the plants of Osceola Products, Osceola, Ark., Helena Cotton Oil, Helena, Ark., and Swift and Company at Memphis began processing cottonseed during the latter part of 1947 and in 1948. Therefore, I would suggest that you move back to 1947 or at least to 1948 your date about the commercialization of the solvent extraction process as applied to cottonseed.

Mrs. M. G. Lambou: The later date used in my slide was chosen since it was more significant for calculation. The mills engaged in solvent extraction for the earlier years mentioned by you were very few and this small volume would not have meant anything statistically when compared to other processing methods that were producing very great outputs. We selected dates for commercialization that were significant as regards output and not dates when the process actually began.

Mr. J. L. Tennent, Jr.: Are there any questions for Mr. White?

Dr. A. E. MacGee: I don't have a question for Mr. White, but I would like to compliment him for a very fine paper about a subject

of utmost importance to all in the oilseed industry. Your suggestion that an organization should bring up the subject of safety at the semiannual meetings held with the company's entire personnel for discussion of the usual other business matters is very appropriate. But I think meetings to discuss safety should be held more frequently at every opportunity. A few years ago I attended a special session devoted to safety at an American Oil Chemists' Society. It was very discouraging to learn that the oil and fat industry had the poorest safety record of any in the chemical industries. That same survey did show, however, that a Procter and Gamble mill was a top mill in safety. I think every processing company needs to devote more time on a dollar and cent basis to safety in their mills.

RESOLUTIONS COMMITTEE REPORT

Mr. Robert Patterson presented the Report of Resolutions Committee which follows:

BE IT RESOLVED, That we express our appreciation and thanks to the program committee and all who have devoted time and effort to the preparation of the excellent program presented at this, the Twelfth Cottonseed Processing Clinic. We also express our thanks to those appearing on the program.

BE IT RESOLVED, That we desire to express to Dr. C. H. Fisher, Director, Mr. E. L. Patton, Assistant Director, and the staff of the Southern Regional Research Laboratory our sincere thanks for the hospitable and kindly manner in which we have been accommodated during our visit here and the further desire that this most pleasant association may be continued.

BE IT RESOLVED, That the work on Mixed Solvent Extraction of Cottonseed Meats be continued at the same level.

BE IF RESOLVED, That the work on Alumina Bleaching of Cottonseed Oil be continued.

BE IT RESOLVED, That the work on the development of a superior cotton linters batting be continued, and that the whole field of developing new uses for cottonseed linters be explored.

BE IT RESOLVED, That we heartily approve of the research being developed by the Crops Research Division of the ARS toward the breeding of a glandless cottonseed and trust that this project will be carried forward; we also heartily approve of the research being conducted by all laboratories to evaluate the oil and meal being produced from glandless seed.

BE IT RESOLVED, That Southern Utilization Research and Development Division make an active effort to examine present methods of delintering cottonseed and to study all possible new methods with the idea of improving the economic effectiveness of the process.

BE IT RESOLVED, That the value of the Cottonseed Processing Clinics has been established as evidenced by the widespread interest and attendance. THEREFORE, BE IT FURTHER RESOLVED that these meetings be continued as a benefit to the economy of the cotton growing industry.

The Resolutions were adopted unanimously by all present.

APPENDIX

ATTENDANCE LIST

Allen, Gene, President, Southland Industrial Products, 3283 Tulane, Memphis, Tenn.

Allen, T. E., Southern Cotton Oil Division, Hunt Foods & Industries, Inc., New Orleans, La.

Baldwin, W. D., Hercules Powder Co., Delaware Trust Bldg., Wilmington 99, Del.

Barnett, Jr., J. P., Vice President, Opelousas Oil Mill, Opelousas, La.

Bartmess, N. P., Kennett Oil Mill, Inc., P. O. Box 41, Kennett, Mo.

Becker, Kenneth W., District Manager, Blaw-Knox Co., East Chicago, Ind.

Brady, Joseph C., Helena Cotton Oil Co., P. O. Box 569, Helena, Ark.

Bredeson, Dean K., Sales Engineer, French Oil Mill Machinery Co., Piqua, Ohio

Brown, G. B., Assistant Superintendent, Planters of Pine Bluff, 1021 East 5th, Pine Bluff, Ark.

Burner, A. H., Vice President, French Oil Mill Machinery Co., Piqua, Ohio

Caldwell, C. H., Superintendent, West Memphis Cotton Oil Mill, West Memphis, Ark.

Caldwell, Jr., Frank B., Independent Oil Mill, Inc., P. O. Box 150, Jackson, Tenn.

Campbell, Woodson, Superintendent, Mississippi Oil Mill, Inc., Hollandale, Miss.

Carden, Joe, Superintendent, Helena Cotton Oil Co., Inc., Helena, Ark.

Coleman, Wm. T., Paymaster Div., Anderson, Clayton & Co., P. O. Box 521, Abilene, Tex.

Doughtie, Jr., R. T., Agr. Marketing Service, U. S. Department of Agriculture, Memphis, Tenn.

Dunklin, Geo. H., Planters of Pine Bluff, Pine Bluff, Ark.

Durham, Warren A., Vice President, National Blow Pipe Co., P. O. Box 52079, New Orleans, La.

Ferrell, F. H., Osceola Products Co., Osceola, Ark.

Fincher, H. D., Process Engineer, Anderson, Clayton & Co., P. O. Box 2538, Houston, Tex.

Fleming, J. T., Superintendent, Planters Manufacturing Co, Clarksdale, Miss.

Flowers, Dick, President, Planters Oil Mill, Tunica, Miss.

Fransen, Rene, President, Mente Bag Company, Inc., Box 8171, New Orleans, La.

French, A. W., French Oil Mill Machinery Co., Piqua, Ohio

Fryer, Herman, Bauer Bros. Co., Shreveport, La.

Garner, C. E., Mississippi Valley Oilseed Processors Assn., 1624 Exchange Bldg., Memphis 3, Tenn.

Geismar, Alfred, Vice President, Geismar & Co., Inc., 316 Baronne St., New Orleans, La.

Gillentine, Ottis, Superintendent, Tupelo Oil Mill, 320 S. Green St., Tupelo, Miss.

Ginaven, M. E., Product Development, Bauer Bros. Co., P. O. Box 509, Springfield, Ohio

Goetz, Arno, Vice President, Reis & Co., Inc., Dallas, Tex.

Grovenstein, S. R., Box 355, Maxton, N. C.

Harper, Garlon A., National Cottonseed Products Assn., 1104 Praetorian Bldg., Dallas 1, Tex.

Hay, Charles, Process Engineer, Anderson, Clayton & Co., P. O. Box 2538, Houston, Tex.

Hayne, W. P., Manager, Independent Mill & Gin, Inc., Alexandria, La.

Henry, Dan L., Assoc. Director, Law & Co., 136 Forrest Ave., N. E., Atlanta, Ga.

Hodges, Lawrence H., Vice President, Barrow-Agee Laboratories, Inc., Memphis, Tenn.

Howard, N. F., Yazoo Valley Oil Mill, Inc., Lock Drawer 927, Greenwood, Miss.

Jenkins, Alfred, President, Delta Cotton Oil & Fertilizer Co., Jackson, Miss.

Johnson, Walter J., Memphis Cotton Oil Mill, Memphis, Tenn.

Johnston, Charles, Louisiana State University, Baton Rouge, La.

Katzenmier, C. Y., Port Gibson Oil Works, Port Gibson, Miss.

Keeton, Robert, Procter & Gamble Co., P. O. Box 599, Cincinnati 1, Ohio

Kolb, M. D., Southern Cotton Oil Div., Hunt Foods & Industries, Inc., Greenville, Miss.

Lanier, W. P., The Buckeye Cellulose Corp., 2899 Jackson Ave., Memphis 8, Tenn.

Lazare, Jr., Rene J., Southern Cotton Oil Div., Hunt Foods & Industries, Inc., New Orleans, La.

Long, R. D., Carver Cotton Gin Co., 1305 Harbor Ave., Memphis 2, Tenn.

Lundmark, J. C., The V. D. Anderson Co., 2016 Southwood Road, Birmingham 16, Ala.

Lyman, Carl M., Department of Biochemistry & Nutrition, Tex. Agr. Expt. Sta., Texas A & M College, College Station, Tex.

MacGee, A. Ernest, Skelly Oil Co., 605 West 47th St., Kansas City 41, Mo.

Mareincheck, Joe, Minter City Oil Mill, Minter City, Miss.

McClure, O. M., Southern Chemical Cotton Co., 45th St. & Central Ave., Chattanooga 10, Tenn.

Moore, N. Hunt, N. Hunt Moore & Associates, 3373 Poplar Ave., Memphis 11, Tenn.

Morgan, F. L., Southern Cotton Oil Div., Hunt Foods & Industries, Inc., New Orleans, La.

Morrison, E. E., President, Eagle Cotton Oil Co., Meridian, Miss.

Patterson, Robert, Trenton Cotton Oil Mill Co., P. O. Box 311, Trenton, Tenn.

Perry, J. B., Vice President & Gen. Manager, Mississippi Cottonseed Products Co., P. O. Box 1125, Grenada, Miss.

Pickard, Robert W., Superintendent, Decatur Cotton Oil Co., 2 West Moulton St., Decatur, Ala.

Rogers, Robert O., Assistant Staff Specialist, Product & Process Evaluation, Agr. Res. Serv., U. S. Dept. of Agriculture, Washington, D. C. 20250

Rother, John R., Industrial Supplies, Inc., Memphis, Tenn.

Roussel, John S., Coordinator Cotton Research, La. State University, Agr. Experiment Station, Box 8877, Baton Rouge, La.

Rowland, Ed, Alloy Hardfacing & Eng. Co., 1209 Clover Dr., Minneapolis, Minn.

Schwill, Ray O., Buckeye Cellulose Corp., 2899 Jackson Ave., Memphis, Tenn.

Simpson, Geo. R., Superintendent, Mississippi Oil Mills, Greenwood, Miss.

Smith, Allen, Perkins Oil Co., P. O. Box 152, Memphis 1, Tenn.

Smith, R. E., Yazoo Valley Oil Mill, Inc., Lock Drawer 927, Greenwood, Miss.

Smith, Walton, Southern Cotton Oil Co., New Orleans, La.

Steinhoff, Paul F., District Engineer, Blaw-Knox Co., Houston, Tex.

Tenent, Jr., E. H., Woodson-Tenent Lab., Box 2135, Memphis, Tenn.

Tennent, Jr., J. L., Superintendent, Delta Products Co., P. O. Box 218, Wilson, Ark.

Upp, Charles, W., Director, Agr. Experiment Sta., Louisiana State University, P. O. Box 8877, University Station, Baton Rouge, La.

Watkins, Leslie R., General Superintendent Oil Mills, Mexico, Anderson, Clayton & Co., Reforma 51, Piso 11, Mexico D.F., Mexico

Watts, A. B., Dept. of Poultry Science, Louisiana State University, Baton Rouge, La.

Weber, L. J., Spec. Sales, Skelly Oil Co., 605 W. 47th St., Kansas City 41, Mo.

White, Max W., Anderson, Clayton & Co., 1201 Cotton Exchange Bldg., Houston, Tex.

White, Reno J., Chemical Plants Div., Blaw-Knox Co., 300 Sixth St., Pittsburgh 22, Pa.

Whitten, M. E., Marketing Research Div., Agr. Marketing Serv., U. S. Dept. of Agriculture, Washington, D C. 20250

Wilcke, Harold L., Vice President, Ralston Purina Co., St. Louis, Mo.

Wiley, A. L., Superintendent, Perkins Oil Mill, 3012 Carrington, Memphis, Tenn.

Woodruff, Ralph, General Manager, Delta Products Company, Box 218, Wilson, Ark.

Woodyard, H. M., General Superintendent, Planters of Pine Bluff, Pine Bluff, Ark.

Woodyard, R. E., Sales Engineer, Carver Cotton Gin Co., 1305 Harbor Ave., Memphis, Tenn.